

Claims:

1. A process for the production of olefins which process comprises feeding (i) a paraffinic hydrocarbon-containing feedstock, (ii) at least one unsaturated hydrocarbon and (iii) a molecular oxygen-containing gas to an autothermal cracker, wherein they are reacted in the presence of a catalyst capable of supporting combustion beyond the normal fuel rich limit of flammability to provide a hydrocarbon product stream comprising olefins.
2. A process according to claim 1, wherein the unsaturated hydrocarbon is one or more of an alkene, an aromatic compound, a diene and an alkyne.
3. A process according to claim 2, wherein the unsaturated hydrocarbon is 1,2 butadiene, 1,3 butadiene, 2 methyl 1,3 butadiene, 1,3 pentadiene, 1,4 pentadiene and/or cyclopentadiene, preferably 1,3 butadiene.
4. A process according to claim 2, wherein the unsaturated hydrocarbon is acetylene, propyne and/or a butyne, preferably acetylene.
5. A process according to claim 2, wherein the autothermal cracker is operated at a total pressure of greater than 5 barg and the unsaturated hydrocarbon is benzene and/or toluene.
6. A process according to any one of the preceding claims wherein the unsaturated hydrocarbon fed to the autothermal cracker comprises at least one unsaturated hydrocarbon other than an alkene, such as at least one of a diene and an alkyne, and less than 1wt%, such as less than 0.5wt%, of total alkenes, based on the weight of paraffinic hydrocarbon fed to the reactor.
7. A process according to any one of the preceding claims wherein the unsaturated

hydrocarbon derives from the product stream of a steam cracking reactor, the off gas stream of a fluid catalytic cracking reactor, the off gas streams of a delayed coker unit, a visbreaker unit or an alkylation unit or from a plastics recycling process, such as pyrolytic polymer cracking.

- 5 8. A process according to any one of the preceding claims wherein the unsaturated hydrocarbon fed to the autothermal cracking reactor derives from the autothermal cracking product stream.
9. A process according to claim 8, which process comprises the steps of:
- 10 (a) feeding a paraffinic hydrocarbon-containing feedstock and a molecular oxygen-containing gas to an autothermal cracker wherein they are reacted in the presence of a catalyst capable of supporting combustion beyond the normal fuel rich limit of flammability to provide a hydrocarbon product stream comprising olefins
- (b) recovering at least a portion of the olefins produced in step (a) and
- (c) recycling at least one unsaturated hydrocarbon produced in step (a) back to
- 15 the autothermal cracker.
10. A process according to claim 9 which process comprises the steps of:
- (a) feeding a paraffinic hydrocarbon-containing feedstock and a molecular oxygen-containing gas to an autothermal cracker wherein they are reacted in the presence of a catalyst capable of supporting combustion beyond the normal fuel rich limit of
- 20 flammability to provide a hydrocarbon product stream comprising ethene and/or propene
- (b) separating the hydrocarbon product stream produced in step (a) into a first stream comprising hydrocarbons containing less than 4 carbon atoms and a second stream comprising hydrocarbons containing at least 4 carbon atoms, including at least
- 25 one unsaturated hydrocarbon containing at least 4 carbon atoms
- (c) recovering ethene and/or propene from the first stream and
- (d) recycling at least a portion of the second stream to the autothermal cracker.
11. A process according to claim 10 wherein the unsaturated hydrocarbon containing at least 4 carbon atoms is selected from 1,2 butadiene, 1, 3 butadiene, 2
- 30 methyl 1,3 butadiene, 1,3 pentadiene, 1,4 pentadiene and cyclopentadiene, and preferably is 1, 3 butadiene.
12. A process according to claim 9 which process comprises the steps of:

(a) feeding a paraffinic hydrocarbon-containing feedstock and a molecular oxygen-containing gas to an autothermal cracker wherein they are reacted in the presence of a catalyst capable of supporting combustion beyond the normal fuel rich limit of flammability to provide a hydrocarbon product stream comprising ethene and/or propene, and at least one alkyne

(b) recovering at least a portion of the ethene and/or propene produced in step (a) and

(c) recycling at least a portion of the at least one alkyne produced in step (a) back to the autothermal cracker.

13. A process for the production of olefins which process comprises feeding a paraffinic hydrocarbon, at least one unsaturated hydrocarbon and a molecular oxygen-containing gas to an autothermal cracker wherein they are reacted in the presence of a catalyst capable of supporting combustion beyond the normal fuel rich limit of flammability to provide a hydrocarbon product stream comprising olefins, said process being characterised in that the total hydrocarbon fed to the autothermal cracker comprises at least 20wt% of unsaturated hydrocarbons.

14. The process according to claim 13 wherein the total hydrocarbon fed to the autothermal cracker comprises at least 10wt% olefins and at least 10wt% aromatics.